



Australian Government

**National Measurement
Institute**



NITP 1
National Instrument Test Procedures for
Length Measuring Instruments

© Commonwealth of Australia 2011

NMI V 11

First edition — December 2004

Second edition — December 2008

NITP 1

First edition — December 2011 (renamed NITP 1)

First edition, first revision — September 2012

National Measurement Institute
Bradfield Road, Lindfield, NSW 2070
PO Box 264, Lindfield, NSW 2070

T (61 2) 8467 3600

F (61 2) 8467 3610

W www.measurement.gov.au

AMENDMENTS

Erratum	Date	Page	Location	Details of change
1	01/09/2012	all	all	Deleted references to certification, updated information, clarified meaning and made minor editorial changes
2	01/09/2012	2	clauses 3.2.1 to 3.2.3	Reworded requirements for instrument characteristics to a statement (from a question)
3	01/09/2012	3	clause 4.2	Updated units of measurement for tension from kilogram force (kgf) to newtons (N)
4	01/09/2012	5	clause 4.3	Added reference to general supplementary certificate S1/0B
5	01/09/2012	6	test report	Added section to record details of equipment and reference standards
6	01/09/2012	8	test report	Amended so able to record scale mark and error result

PREFACE

On 30 June 2010 the uniform test procedures (i.e. relevant NMI V documents) were deemed to be national instrument test procedures (NITPs) for the purposes of section 18GG of the *National Measurement Act 1960* (Cth).

In 2011 the NITPs were renumbered to better align the numbers with the classes of pattern approval and servicing licensee. As a result this document (NMI V 11) became NITP 1.

The only changes that have been made to the latest edition of this document are it has been rebranded, renumbered, renamed and its cross-references have been updated. In all other respects it is identical with NMI V 11.

NMI's Chief Metrologist has determined that NITP 1 contains the test procedures for the verification of length measuring instruments.

ABBREVIATIONS

d actual scale interval
MPE maximum permissible error

CONTENTS

Amendments	ii
Preface	ii
Abbreviations	ii
Explanation of Terms	iv
1. Scope	1
2. Equipment	1
3. Visual Inspection	1
3.1 Required Data	1
3.2 Characteristics of the Instrument	1
4. Test Procedures	2
4.1 Accuracy Test — Rigid Measures	3
4.2 Accuracy Test — Flexible Measures	3
4.3 Accuracy Test — Fabric Measuring Instruments	4
5. Suggested Sequence for Testing	4
Appendix A. Test Report	4

EXPLANATION OF TERMS

For explanations of other terms see *General Information for Test Procedures*.

Adjustment

Alteration of the measurement parameters to bring the instrument within the allowable MPEs for an instrument in use.

Calibration

The set of operations that (under specified conditions) establishes the relationship between the indicated or nominal value of an instrument and the corresponding known value of the measured quantity.

In-service Inspection

The examination of an instrument by a **trade measurement inspector** to check that:

- the verification mark is valid; and
- the errors do not exceed the MPEs permitted for in-service inspection.

In-service inspection does not permit the instrument to be marked with a verification mark.

Verification

The examination of an instrument by a **trade measurement inspector, servicing licensee or an employee of a servicing licensee** in order to mark the instrument indicating that it conforms with the relevant test procedures.

Initial verification is the verification of a new instrument which does not bear a verification mark and has never been verified before.

1. SCOPE

NITP 1 describes the test procedures for the verification and in-service inspection of length measuring instruments to assess whether they measure to within the maximum permissible errors (MPEs) specified in Schedule 1 of the *National Trade Measurement Regulations 2009* (Cth) and that they comply with their certificate(s) of approval.

Length measuring instruments include **simple length measures** and **fabric measuring instruments**.

Simple length measures (both rigid and flexible) are based on general certificates of approval:

- 1/0 Length Measures of 100 mm to 100 m (cancelled); or
- 1/0/A Length Measures of 100 mm to 100 m (current); or
- 1/1 One Metre Measure and Variants (cancelled).

Fabric measuring instruments are based on:

- general certificate of approval 1/2A/0 Fabric-measuring Instruments; or
- *NMI M 1. Pattern Approval Specifications for Length Measuring Instruments*.
Note: The specifications in NMI M 1 also apply to the measurement of wire and cordage, but no test procedures are given for wire and cordage in this document.

All instruments must also comply with the *National Measurement Act 1960* (Cth), the *National Measurement Regulations 1999* (Cth) and the *National Trade Measurement Regulations 2009* (Cth).

2. EQUIPMENT

Record details of the equipment used on the test report.

1. Certificate(s) of approval.
2. Appropriate reference standard of length. The reference standards of measurement shall comply with the uncertainties and variations permitted in the *National Measurement Regulations 1999* (Cth). The combined uncertainties and variations shall be three times better than the MPE of the instrument being tested (i.e. not greater than one-third of the MPE of the length measure or measuring instrument under test).

Note: The MPE for the corresponding length measure or measuring instrument varies throughout its

length for each type of length measure described in this document.

3. Current Regulation 13 certificates for all reference standards of measurement.
4. Certified comparator (if applicable).
5. Test bench for flexible measures.
6. Test report (see Appendix A).

3. VISUAL INSPECTION

Visually inspect the length measuring instrument and determine if:

- all the required data is supplied; and
- the applicable characteristics are correctly marked.

Record details on the test report.

3.1 Required Data

1. Test report number.
2. Date of test.
3. Verifier's name.
4. Type of test: verification or in-service inspection (ensure that the verification mark is in place for in-service inspection and reverification).
5. Name of owner/user.
6. Address of owner/user.
7. Name of contact person on premises.
8. Address of instrument location.
9. Description of instrument.
10. Manufacturer.
11. Model.
12. Serial number (not required for instruments approved under a general certificate).
13. Certificate(s) of approval number.
14. Maximum length.
15. Verification scale interval.
16. For fabric measuring instruments:
 - year of manufacture;
 - maximum speed of material;
 - minimum speed of material;
 - minimum delivery; and
 - additional material suitability limitations.

3.2 Characteristics of the Instrument

Where applicable, the length measuring instrument and its use shall comply with clauses 3.21 to 3.2.3.

3.2.1 General Characteristics

1. The instrument shall comply with its certificate(s) of approval.
2. The instrument shall be used in an appropriate manner.
3. All mandatory descriptive markings shall be clearly and permanently marked on the data plate.
4. Where applicable, the data plate shall be fixed on the instrument.
5. The instrument shall be complete.
6. The instrument shall be clean.
7. The instrument shall be operational.
8. The operation of the instrument shall be free of any apparent obstructions.
9. Where applicable, the instrument shall be securely mounted on a firm and level base.
10. The operator (and where applicable, the customer) shall have a clear and unobstructed view of the indicating device and the whole of the measuring process.
11. Where applicable, the instrument shall be adequately protected against abnormal dust, air movement, vibrations, atmospheric conditions and any other influence likely to affect its performance.
12. For additional indicating devices: they comply with the applicable general supplementary certificates S1/0B or S1/0A (or S1/0 or S2/0).

3.2.2 Characteristics of Measures

1. The measure shall be free of any sign of excessive wear or kinking which could affect its accuracy.
2. The measure shall be made of an approved material.
3. Where the measure has hinged joints, the joints shall be firm and the measure shall be straight when extended.

4. Any measure not sub-divided legibly shall be marked 'not sub-divided'.
5. The scale marks shall be in accordance with *NMI P 105 Pattern Approval Specifications for the Graduation of Analogue Scales*.
6. The measure shall only be marked in metric units.
7. The measure shall be free of a trade or other mark, which may be mistaken for either the denomination or the verification mark.
8. If wooden, the measures shall have securely fixed metal ends.
9. Any end surface forming a principal scale mark shall be flat and perpendicular to the longitudinal axis of the measure.

3.2.3 Characteristics of Fabric Measuring Instruments

1. The type of material that the instrument is designed to measure shall be marked on the data plate.
2. There shall be an over-measure protection device.

4. TEST PROCEDURES

The following series of test procedures determine if the performance of a length measuring instrument meets requirements and whether, in the case of a fabric measuring instrument, it requires adjustment or service.

Each test procedure is explained as a discrete test. A suggested sequence for testing is shown in clause 5.

The MPEs for verification and in-service inspection shall be in accordance with Table 1 or as specified in the certificate of approval.

It may be necessary to use a certified magnified pocket comparator or similar to compare scale marks.

Record results on the test report.

Table 1. MPEs for length measuring instruments ('d' is scale interval)

Type of instrument	Range	Verification	In-service inspection
Flexible and rigid measures	not more than 500 mm	±0.5 mm	
	more than 500 mm but not more than 2 m	±1.0 mm	
Flexible measures	more than 2 m but not more than 100 m	±0.05%	
Fabric measuring instruments	analogue scale mark	±0.5%	±1.0%
	digital scale mark	±0.5% + 0.5 d	±1.0% + 0.5 d

4.1 Accuracy Test — Rigid Measures

1. Place the reference standard on a smooth, level bench.
2. Butt the measure against the reference standard so that the edges with the scale marks face each other.

Note: Where the measure is of a different height to that of the reference standard and the height of the surface is not adjustable, the lower of the two measures may be packed up or the measure can be stood on its edge at right angles to the reference standard.

3. Select a minimum of five scale marks on the measure which are approximately equally spaced from zero to the maximum length.
4. Align the zero scale marks of the measure and the reference standard.
5. Determine the error for each scale mark selected in step 3.
6. Determine if the errors are within the MPE.

4.2 Accuracy Test — Flexible Measures

Flexible measures are generally tested in a laboratory. Flexible measures shall be:

- fully supported throughout their length on a level base or supported in such a way that an accurate comparison may be made; and
- subject to a tension of 20 N \pm 10% for synthetic materials, and 50 N \pm 10% for metal, unless the measure is marked otherwise.

If the length of the reference standard or test bench is less than the length of the measure then the substitution method is required. For measures:

- ≤ 8 m, use a rigid reference standard and test bench $\geq 50\%$ of the length of the measure;
 - > 8 m, use a flexible reference standard and test bench ≥ 8 m or 25% of the length of the measure, whichever is greater.
1. Place the reference standard on a smooth, level test bench. If the reference standard is flexible apply the required tension.
 2. Lay the measure alongside the reference standard and apply the tension stated in the Regulation 13 certificate.

3. Allow the reference standard and the measure to rest on the test bench for at least 15 min.
4. Select a minimum of five scale marks on the measure, approximately equally spaced from zero to the maximum length and where applicable select suitable substitution scale marks.

Note: If an actual value reference standard is used, select scale marks as close as practical to a calibrated scale mark on the reference standard.

Any substitution scale mark is selected at the discretion of the inspector/licensee and depends on the tensioning arrangements; generally it relates to the last scale mark on the reference standard.

5. Align the zero scale marks of the flexible measure and reference standard.
6. Determine the error for each scale mark (including any substitution scale mark) selected in step 4 that is within the tensioned portion of the reference standard.

Note: The error for any substitution scale mark shall be determined to an accuracy of 0.1 mm.

7. Determine if the errors are within the MPE. However, if substitution is required continue steps 8 to 15.
8. Record the nominal value of the substitution scale mark and corresponding error for that mark.

Note: For the first substitution this mark and error will be determined in step 6 and for all subsequent (up to a maximum of 3) substitutions this mark and error will be determined in step 13.

9. Remove the tension from the measure and align the substitution scale mark selected in step 6 with the zero scale mark of the reference standard.
10. Tension the measure and allow the measure to rest on the test bench for at least 15 min.
11. Realign the substitution scale mark with the zero mark of the reference standard to an accuracy of at least 0.1 mm.
12. Determine the difference between the measure and the reference standard for each scale mark and the next substitution

mark/s (if applicable) within the tensioned portion of the reference standard.

13. Calculate the actual error for each scale mark and substitution mark by adding the substitution mark error (step 8) to each difference determined in step 12.
14. Determine if the errors are within the MPE.
15. Repeat steps 8 to 14 until the complete length of the measure has been compared against the reference standard.

4.3 Accuracy Test — Fabric Measuring Instruments

The reference standard shall:

- be equal to the capacity for instruments with a capacity <1 500 times the minimum scale interval;
 - be at least 1 500 times the minimum scale interval for instruments with a capacity $\geq 1\ 500$ times the minimum scale interval, e.g. for a 1 cm interval it shall be a minimum length of 15 m; and
 - be made of a stable, woven material (e.g. nylon sail cloth) of a minimum length of 12 m and graduated at suitable intervals.
1. Place an arbitrary reference mark on the frame of the instrument after the measuring mechanism. This mark shall be perpendicular and within 5 mm of the edge of fabric as it is drawn through the instrument.
Note: This is most readily achieved by using the edge of a piece of masking tape.
 2. Draw the reference standard between the measuring and pressure wheels until the zero mark on the reference standard aligns with the reference mark.
 3. Reset the indicator to zero.
Note: Take care not to cut the reference standard when setting up instruments fitted with a cutter.
 4. Select a minimum of five scale marks on the instrument which are approximately equally spaced from zero to the maximum length.
 5. Draw the reference standard through the instrument stopping to compare the error at each scale mark.
 6. Determine if the errors are within the MPE.

7. If an instrument is fitted with two or more measuring mechanisms, repeat steps 1 to 6 for each mechanism.
8. If an instrument is fitted with a totaliser, ensure that it operates correctly throughout the tests.
9. If an instrument is fitted with a printing device, check that the printed data shows the same length and units of measurement as indicated by the instrument.
10. For additional indicating devices: ensure that they exactly repeat the information on the primary indicator, and that any ticket/label-printing device complies with the applicable general supplementary certificate S1/0B or S1/0/A (or S1/0 and S2/0 for devices initially verified prior to March 1992).

5. SUGGESTED SEQUENCE FOR TESTING

1. Make sure that any electronic instrument has been allowed to warm up for about half an hour.
2. Check the certificate(s) of approval for any additional tests required. Make provision for including these tests in the testing sequence.
3. Visually inspect the instrument and record the required details on the test report.
4. Conduct the appropriate accuracy test (clause 4.1, 4.2 or 4.3).
5. Determine whether the instrument has passed or failed.
6. Carry out anything else you need to do to complete the procedure. See *General Information for Test Procedures* for more information. This may include:
 - obliterating the verification mark from the instrument;
 - applying a verification mark; and
 - applying a seal.

APPENDIX A. TEST REPORT

The following test report contains the minimum amount of information that must be recorded.

If the certificate of approval requires additional tests, attach pages that record the results of these tests.

Number each page of the test report in the style shown at the top of each page.

Test Report for Length Measuring Instruments

Test report number.....Date of test.....

Type of test (tick one) Verification In-service inspection

For in-service inspection or reverification, record the verification mark.....

Name of owner/user

Address of owner/user

Name of contact person on premises

Address of instrument location.....

Description of instrument

Manufacturer Model.....

Serial number (if applicable) Certificate of approval number

Maximum length Verification scale interval.....

For fabric measuring instruments

Year of manufacture

Maximum speed of material

Minimum speed of material

Minimum delivery.....

Additional material suitability limitations

Details of the Equipment and Reference Standards of Measurement (clause 2)

Reference standards	
Make	
Model	
Serial number	
Length	
Regulation 13 certificate number	
Certificate expiry date	
Certified comparator (if applicable)	
Make	
Model	
Serial number	
Calibration expiry date	

General Characteristics (clause 3.2.1)	yes/no/na
Does the instrument comply with its certificate(s) of approval?	
Is the instrument being used in an appropriate manner?	
Are all mandatory descriptive markings clearly and permanently marked on the data plate?	
If applicable, is the data plate fixed on the instrument?	
Is the instrument complete?	
Is the instrument clean?	
Is the instrument operational?	
Is the operation of the instrument free of any apparent obstructions?	
If applicable, is the instrument securely mounted on a firm and level base?	
Does the operator (and where applicable, the customer) have a clear and unobstructed view of the indicating device and the whole of the measuring process?	
If applicable, is the instrument adequately protected against abnormal dust, air movement, vibrations, atmospheric conditions and any other influence likely to affect its performance?	

Characteristics of Measures (clause 3.2.2)	yes/no/na
Is the measure free of any sign of excessive wear or kinking which could affect its accuracy?	
Is the measure made of an approved material?	
If the measure has hinged joints, are the joints firm and is the measure straight when extended?	
Is any measure not sub-divided legibly marked 'not sub-divided'?	
Are the scale marks in accordance with NMI P 105?	
Is the measure only marked with metric units?	
Is the measure free of a trade or other mark, which may be mistaken for either the denomination or the verification mark?	
If wooden, do the measures have securely fixed metal ends?	
Is any end surface forming a principal scale mark flat and perpendicular to the longitudinal axis of the measure?	

Characteristics of Fabric Measuring Instruments (clause 3.2.3)	yes/no
Is the type of material that the instrument is designed to measure, marked on the data plate?	
Is there an over-measure protection device?	

Test Results

Accuracy test — rigid measures (clause 4.1)		Scale mark	Error
		<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
Accuracy test — flexible measures (clause 4.2)		Scale mark	Error
Applied tension	N		
		<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
Accuracy test — fabric measuring instruments (clause 4.3)		Scale mark	Error
		<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
Totaliser		<input type="checkbox"/> Pass <input type="checkbox"/> Fail	<input type="checkbox"/> na
Printer		<input type="checkbox"/> Pass <input type="checkbox"/> Fail	<input type="checkbox"/> na
Auxiliary indicating device(s)		<input type="checkbox"/> Pass <input type="checkbox"/> Fail	<input type="checkbox"/> na
Other test		<input type="checkbox"/> Pass <input type="checkbox"/> Fail	<input type="checkbox"/> na
Overall result		<input type="checkbox"/> Pass <input type="checkbox"/> Fail	

Verifier's name..... Identification number.....

Signature

Comments

.....

